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Extraction of cesium and americium with p-alkylcalix[8]arenes from alkaline solutions

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Abstract

© 2016, Pleiades Publishing, Inc.Previously unknown isononylcalix[8]arene was synthesized from commercially available isononylphenol. The properties of the product (solubility, extraction ability, tendency to aggregation) were compared with those of the known tert-butylcalix[8]arene. The extraction of 137Cs, 99mTc, and 241Am from alkaline carbonate solutions with solutions of p-alkylcalix[8]arenes (alkyl = tert-butyl, isononyl) in tetrachloroethylene was studied. The dependence of the distribution ratios on pH of the aqueous phase in the interval from 11 to 13.9 and on the nature of functional groups in the calixarene core was determined. The composition of extractable solvates of cesium and americium with calix[8]arenes was found. Calix[8]arenes extract cesium from alkaline solutions more efficiently than p-tert-butylphenol, their nonmacrocyclic analog, does. tert-Butylcalix[8]arene exhibits the highest performance, which may be due to formation of aggregates 5.7 ± 0.8 nm in diameter in the organic phase at pH 13.5 of the aqueous phase. The isononyl derivative exists in the monomeric form (particle diameter 1.9 ± 0.5 nm).

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Keywords

alkaline solutions, americium-241, calix[8]arenes, cesium-137, extraction, nanoaggregates